高溫超導釔鋇銅氧諧波抑制濾波器之特性與釔鋇銅氧薄膜微波性質之退火效應之研究

李訓發、王立民 ; 吳俊德

E-mail: 9707880@mail.dyu.edu.tw

摘 要

本研究設計窄頻帶通濾波器並能夠有效抑制高次諧波產生。 傳統上濾波器結構採用半波長諧振器設計理論，除了基本頻率fo外，另外產生二次諧波與三次諧波的高階諧振模式，利用不同阻抗比值的諧振器來設計濾波器，此方式可達到具有相同的基本頻率fo，不同的諧波的頻率，來達到相互抑制高階諧波產生。模擬與量測結果顯示出諧波能夠有效抑制在-20以下。電路製程上使用射頻磁控濺鍍法在15mm×15mm雙拋鋁酸鑭(LaAlO3)基座上成長高品質雙面釔鋇銅氧(YBa2Cu3Oy)薄膜，製作高溫超導濾波器。YBCO薄膜進行550 °C通氧退火處理，發現其臨界溫度由88.1K改善至88.9K、品質因素Qu=3912提升至Qu=4378 ，表面阻抗由0.504 mΩ下降至0.472 mΩ。

關鍵詞 : 步階阻抗 ; 交錯耦合 ; 諧坡抑制 ; 臨界溫度

目錄

參考文獻

[1] T.Kinpara, M.Kusunoki, M.Mukaaida, and S.Ohsima,“ Design ofcross-coupled microstrip bandpass filter, ” Physica C vol. 357-360 pp.1503-1506,2001.

[2] Balan A. Willemsen, IEEE Trans. Appl. Supercond., vol. 11,pp.30- 67, March 2001 [3] K. Wada, K. Nakarawa, O. Hashimoto, H. Harada,“ A method For Improving Out-Of-Band Characteristic Of λ /2 Microstrip Line Resonator Bandpass Filters ”,proceedings of APMC2001, pp.637-640,2001.

[4] S.Denis,Ch. Person, S. Toutain, B. Theron and S. Vigneron.“ Parallel coupled microstrip filter with phase difference compensation, ” IEEE Electronics letters 26th ,Vol. 31 No.22, October 1995,pp.1927-1928.

[5] M. Makimoto, and S. Yamashita,“ Bandpas filters using parallel coupled stripline stepped impedance resonators, ” IEEE Trans. Microwave Theory Tech., vol. 28, pp. 1413-1417, Dec. 1980.

[6] M. Makimoto, and S. Yamashita, Microwave Resonators and Filters for wireless Communication-Theory and Design, Springer, Berlin, 2001, Chapter 4 [7] J. S. Hong, and M. J. Lancaster, ”Theory and experiment of novel microstrip slow-wave open-loop resonator filters, ” IEEE Trans. Microwave Theory Tech. Vol. 45, pp. 2358-2365, Dec. 1997.
[8] Sheleg, B., and B. E. Wpielman, “ Broadband directional couplers using microstrip with dielectric overlays, ” IEEE Trans. Microwave Theory Tech. Vol.22, pp 1216-1220, Dec. 1974.
[9] Klein, J. L. , and K. Chang, “ Optimum dielectric overlay thickness for equal even- and odd-mode phase velocities in coupled microstrip circuit, ” Electronics Letters, vol. 26, pp. 274-276, 1990.
[10] J.-T. Kuo,W.-H. Hsu, andW.-T. Huang, “ Parallel coupled microstrip filters with suppression of harmonic response, ” IEEE Microwave Wireless Comp. Lett., vol. 12, pp. 383 – 385, Oct. 2002.
[11] Sheng-Fuh Chang, Yng-Huey Jeng, Jia-Liang Chen, ” Tapped wiggly-coupled technique applied to microstrip bandpass filters for multi-octave spurious suppression, ” IEEE Electronics Letters, vol. 40, pp. 46-47, Jan. 2004.
[12] R. Qiang; Y. Wang,and D. Chen, ” A Novel Microstrip bandpass filter with two cascaded PBG structure, ” IEEE Int. Antennas Propagat. Symp. Dig. vol. 2, pp. 510-513, July 2001.
[13] Hu Rong, Zhang Xue Xia, Gao Bao Xin, ” 2-D PBG structure in microstrip line and symmetrical microstrip line, ” Proceedings of APMC 2000, pp. 1218-1221.
[14] Daisuke Okai, Masanobu Kusunoki, Masashi Mukaida, and Shigetoshi Ohshima “ New Measurement Technique of the Surface Impedance of SuperconductorsUsing the Probe-Coupling Type Microstripline Resonator ” [15] J. S. Martens, V. M. Hietala, D. S. Ginley,and T. E. Zipperian “ Confocal resonators for measuring the surface resistance of high-temperature superconducting films ” Appl. Phys. Leyy.58(22), 3 June 1991.
[16] Charles Wilker, Zhi-Yuan Shen, Philip Pang, Dean W. Face, ” 5 GHz High-Temperature-Superconductor Resonators with High Q and Low Power Dependence up to 90 K ” IEEE Transactions On Microwave Theory And Techniques, Vol. 39, No. 9, September 1991 [17] X. Z. Liu, Y. R. Li1 and B. W. Tao ” Growth and Characterization of YBCO Thin Films by Sequential Deposition and Annealing ” Journal of Superconductivity [18] Inki Hong, Hyunseok Hwang, Yung-Hee Han, Sang-Chul Han, Tae-Hyun Sung, and Kwangsoo “ Effects of the Platelet Structures on the Melt Textured Growth YBCO Superconductors ” IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, vol. 13, NO. 2, JUNE 2003 3165 [19] Zhi-Yuan Shen, “ High-Temperature Superconducting Microwave Circuits, ” 高立, 民國86年.
[20] Terry P. Orlando,Kevin A. Delin, “ Foundations of Applied Superconductivity , ” Addison-Wesley Publishing Company, Inc., 1995.
[21] R. Levy, “ Filters with single transmission zeros at real and imaginary frequencies, ” IEEE Trans. Microwave Theory Tech., vol. 24, pp 172-181, Apr. 1976.
[22] J. S. Hong and M. J. Lancaster, “ Design of highly selective microstrip bandpass filters with a single pair of attenuation poles at finite frequencies, ” IEEE Trans. Microwave Theory Tech. ,vol MTT-48, pp 1098-1107, July 2000.
[23] Sheng-Yuan Lee and Chih-Ming Tsai , “ New cross-coupled filter Design using improved hairpin resonators, ” IEEE Trans. Microwave Theory and Tech.,vol.48,No.12, Dec.2000, pp.2482-2490 [24] Hun Nam , Hyeonjin Lee, Yeongseog Lim , “ A design and fabrication of bandpass filter using miniaturized microstrip square SIR, ” Electrical and Electronic Technology , 2001. TENCON. Proceedings of IEEE Region 10 International Conference on,Volume:1 ,2001,pp.395-398 [25] J. S. Wong, ” Microstrip tapped-line filter design, ” IEEE Trans. Microwave Theory Tech. vol. 27, pp.44-50, Apr. 1979.
[26] S. Y. Lee, C. M. Tsai, “ New cross-coupled filter design using improved hairpin resonators, ” IEEE Trans. Microwave Theory Tech., vol. 48, pp.2482-2490, Dec. 2000.
[27]李勝源 “ 具有額外傳輸零點之小型化微波平面式濾波器設計 ” 博士論文, 成功大學電機系, 民國91年 [28] J. S. Hong and M. J. Lancaster , “ Theory and experiment of novel microstrip slow-wave open-loop resonator filters, ” IEEE Trans. Microwave Theory and Tech.,vol.45,No.12,pp.2358-2365, Dec.1997 [29] Eisberg Robert, "量子物理學, " 民國77年 [30] June . Takemoto, Charles M. Jackson, Roger Hu,John F. Burch, Kenneth P. Daly, and Randy W. Simon. ” Microstrip Resonators And Filters Using High-Tc Superconducting Thin Films On LaAlo3 ” [31] Chi-Feng Chen, Ting-Yi Huang, and Ruey-Beei Wu “ Design of Microstrip Bandpass Filters WithMultiorder Spurious-Mode Suppression ” IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, VOL. 53, NO. 12, DECEMBER 2005 [32] Li-Min Wang, S. M. Chiou, M. L. Chu, C. W. Wu, M. C. Chang, Chung-I G. Hsu, D. S. Hsieh, and Jau-Han Chen “ Cross-Coupled YBCO Filters With Spurious Suppression Using Tap-Connection Technique and Skew-Symmetric Feeds ” IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 17, NO. 2, JUNE 2007 [33] 謝東憲 “ 可抑制諧波之高溫超導濾波器研究 ” 碩士論文, 大葉大學電機系, 民國92年 [34] Jinhue , Keikichi Nakamura, “ Relaxation of crystallographic defects in YBa2Cu3o7- δ thin films by heat treatment and its effects on Tc ” Physica C 254(1995) 113-123.